<u>Ex</u> Find the PFE for

$$\frac{5x^2 - 10x + 13}{(x-2)(x^2 + 9)} \quad \xleftarrow{deg=2} \quad = \quad \frac{A}{x-2} + \frac{Bx+C}{x^2+9}$$

deg = 3 bigger ✓

<u>Step 1</u>, <u>Step 2</u>
done

Multiply
through
by
$(x-2)(x^2+9)$

$$5x^2 - 10x + 13 = A(x^2+9) + (Bx+C)(x-2)$$

Plug in x=2:

$$5(2)^2 - 10(2) + 13 = A(2^2 + 9) + 0$$

$$\cancel{20} - \cancel{20} + 13 = A(13) \implies \boxed{A = 1}$$

$$\implies 5x^2 - 10x + 13 = \overset{A}{1}(x^2 + 9) + (Bx + C)(x-2)$$

No more good values to plug in :((no roots
for $x^2 + 9$)

Expand, & combine like terms:

$$5x^2 - 10x + 13 = (x^2 + 9) + Bx^2 - 2Bx + Cx - 2C$$

$$5x^2 - 10x + 13 = (1 + B)x^2 + (-2B + C)x + 9 - 2C$$

$$\begin{cases} 5 = 1 + B \implies \boxed{B = 4} \\ -10 = -2B + C \\ 13 = 9 - 2C \implies 4 = -2C \implies \boxed{C = -2} \end{cases}$$

Putting it all together,

$$\frac{5x^2 - 10x + 13}{(x-2)(x^2+9)} = \boxed{\frac{1}{x-2} + \frac{4x - 2}{x^2 + 9}}$$